



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 10/815,873 | 04/02/2004 | Otto Machhammer | 239016US0 | 1032 |

22850 7590 10/23/2006

C. IRVIN MCCLELLAND
OBLON, SPIVAK, MCCLELLAND, MAIER & NEUSTADT, P.C.
1940 DUKE STREET
ALEXANDRIA, VA 22314

EXAMINER

OH, TAYLOR V

ART UNIT PAPER NUMBER

1625

DATE MAILED: 10/23/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

| | | | |
|------------------------------|--------------------------------------|--|--|
| Office Action Summary | Application No. 10/815,873 | Applicant(s) MACHHAMMER ET AL. | |
| | Examiner Taylor Victor Oh | Art Unit 1625 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 23 November 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-32 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-32 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 02 April 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date <u>04.05.11/04</u> . | 6) <input type="checkbox"/> Other: _____ |

Art Unit: 1625

The Status of Claims

Claims 1-32 are pending.

Claims 1-32 are rejected.

DETAILED ACTION

1. Claims 1-32 are under consideration in this Office Action.

Priority

2. It is noted that the application claims benefit of 60/461,136 (04/09/03); it has a foreign priority document, Germany 10316465.0. (04/09/2003).

Drawings

3. The drawing filed on 4/02/04 are accepted by the Examiner .

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 1-14 and 17-32 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for a titanium- containing silicon oxide

as a solid state catalyst as shown in the following formula:
$$\text{Mo}_1\text{V}_b\text{M}^1_c\text{M}^2_d \quad (I)$$

Art Unit: 1625

M¹ = Te and/or Sb,

M² = at least one of the elements from the group consisting of Nb,

Ta, W, Ti, Al, Zr, Cs, Ca, Sr, Ba, Cr, Mn, Ga, Fe, Ru, Co, Rh, Ni, Pd, Pt, La,

Bi, Pb, Cu, Re, Ir, Y, Pr, Nd, Tb, Ce, Sn, Zn, Si, Na, Li, K, Mg, Ag, Au and In,

b = from 0.01 to 1

c = from > 0 to 1 and

d = from > 0 to 1.

, this does not reasonably

provide enablement for all kinds of catalysts known in the art. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to include all kinds of catalysts unrelated to the claimed invention commensurate in scope with these claims.

Furthermore, the instant specification fails to provide information that would allow the skilled artisan to practice the instant invention without undue experimentation.

Attention is directed to *In re Wands*, 8 USPQ2d 1400 (CAFC 1988) at 1404 where the court set forth the eight factors to consider when assessing if a disclosure would have required undue experimentation, citing *Ex Parte Forman*, 230 USPQ 546 (BdApls 1986) at 547 the court recited eight factors:

- 1) the quantity of experimentation necessary,
- 2) the amount of direction or guidance provided,
- 3) the presence or absence of working examples,
- 4) the nature of the invention,
- 5) the state of the prior art,
- 6) the relative skill of those in the art,
- 7) the predictability of the art, and

Art Unit: 1625

8) the breath of the claims.

The Nature of the Invention

The nature of the invention in claim 1 is the process for heterogeneously catalyzed partial oxidation of propane and /or isobutane to at least one of the target products acrylic acid, methacrylic acid, by passing over a solid state catalyst.

The State of the Prior Art

The states of the prior art are described as followed:

Borgmeier (US 6,858,754 B2) discloses a process for preparing acrylic acid by heterogeneously catalyzed partial oxidation of propane by a process in which the steam content of the reaction gas starting mixture is reduced in the process;

Bogan et al (EP 1193240 A1) discloses a method of producing unsaturated carboxylic acids by subjecting alkanes to vapor phase

catalytic oxidation in the presence of $A_n M_m N_n X_r O_o$;

[0011] Japanese Laid-Open Patent Application No. 07 - 053448 discloses the preparation of acrylic acid by the gas-phase catalytic oxidation of propene in the presence of a mixed metal oxide catalyst of the formula



wherein X is at least one element selected from Nb, Ta, W, Ti, Al, Zr, Cr, Mn, Fe, Ru, Co, Rh, Ni, Pd, Pt, Sb, Bi, B, In, Li, Na, K, Rb, Cs and Ce; a = 0.25 - 0.98; b = 0.003 - 0.5; c = 0.003 - 0.5; d = 0.003 - 0.5 and n is determined by the oxidation state of the other elements.

Art Unit: 1625

[0012] Similarly, Published International Application No. WO 2000/09260 discloses a catalyst for the selective oxidation of propene to acrylic acid and acrolein which comprises a mixed metal oxide of molybdenum, vanadium, lanthanum, palladium niobium, and copper and/or chromium wherein the metals are present in the ratios given by the formula



wherein X = Cu and/or Cr; a = 1; b = 0.01 to 0.9; c = greater than zero to 0.22; d = 0.0000001 to 0.2; e = 0 to 0.2; and f = 0 to 0.2.

[0013] Published International Application No. WO 2000/29105 discloses an improved catalyst system for the oxidation of alkanes and alkenes having a calcined composition of



wherein X is at least one element selected from the group consisting of La, Te, Ge, Zn, Si, In and W; a is 1; b is 0.01 to 0.9; c is >0 to 0.2; d is 0.0000001 to 0.2; e is >0 to 0.2; and f is >0 to 0.5. The elements are preferably present in combination with oxygen in the form of various oxides.

[0014] Published International Application No. WO 2000/29106 discloses an improved catalyst system for the selective oxidation of propane having a calcined composition of



wherein X is at least one element selected from the group consisting of La, Te, Ge, Zn, Si, In and W; a is 1; b is 0.01 to 0.9; c is >0 to 0.2; d is 0.0000001 to 0.2; e is >0 to 0.2; and f is >0 to 0.5. The elements are preferably present in combination with oxygen in the form of various oxides

As the prior art have been discussed in the above, there is no conclusive data that all the kinds of solid catalyst in the process of heterogeneously catalyzed partial oxidation of propane and /or isobutane to at least one of the target products acrylic acid would not work to produce the final desired product since there were only certain combinations of solid catalyst useful in the partial oxidation process.

The predictability or lack thereof in the art

In the instant case, the instant claimed invention is highly unpredictable since one skilled in the art would recognize that any solid catalyst would not work on the claimed process in the same way as certain combined catalysts such as a

$\text{Mo}_1\text{V}_b\text{M}^1_c\text{M}^2_d$ (I) disclosed in the specification.

According to T.P.Hilditch, the author of the "Catalytic Processes in Applied Chemistry" (see pages Xiii-XV, 1929), there is a definitive reason for an unpredictable aspect of the catalysts in the art of organic chemistry. T.P.Hilditch expressly teaches that any catalyst would not work for any kind of the reaction process; for example, the specific catalysts such as mineral acids, acetic anhydride, sulfuric acid, calcium chloride, and etc can be used for the esterification; on the other hand, this same kind of catalyst will not apply to the other types of the reaction process in the followings: the chlorination of organic compounds, the oxidation of organic compounds, the process for rubber accelerators, the hydrogenation or the dehydrogenation processes, ammonia synthesis, ammonia oxidation, sulfuric acid manufacture, and etc. (see pages Xiii-XV).

Furthermore, the specification of the claimed invention does support the very idea of the unpredictable aspect of the catalysts by disclosing the following specific, workable catalyst for the oxidation, not all kinds of the catalyst known in the art.

Moreover, the case law advocates that the catalyst compositions represent an unpredictable aspect in the art of organic chemistry. See Exparte Sizto, 9 USPQ2d

Art Unit: 1625

2081 (Bd. Of App. And Inter. March 1988). Therefore, the use of a generic phrase "a catalyst" can not ensure to form the desired claimed product in a good yield.

The amount of direction or guidance present

The direction present in the instant specification is that not any catalyst can be led to the formation of the desired product. According to the specification, it is silent as to how any solid catalyst can be led to the formation of the desired product and fails to provide guidance as to whether any solid catalyst is sufficient enough to allow to form the desired product in sufficient quantities; the specification fails to provide a correlation between the claimed process of the invention and the functional language of any solid catalyst.

The presence or absence of working examples

There is only 1 working example using the $\text{Mo}_{0.1}\text{V}_{0.29}\text{Ta}_{0.13}\text{Nb}_{0.13}\text{O}_x$ catalyst composition for producing the desired compound in the specification. This can not be the representatives for all the catalysts which would work for the claimed process. Thus, the specification fails to provide enough working examples as to how the other types of catalysts can be resulted in the claimed products, i.e. again, there is no correlation between the functional language of any solid catalyst and the desired final product.

The breadth of the claims

The breadth of the claims is that any solid catalyst would work on the claimed process in the same way as the disclosed catalyst without considering the affect or

Art Unit: 1625

impact of the different catalysts on the starting compound , thereby affecting the yield of the desired final product.

The quantity of experimentation needed

The quantity of experimentation needed is undue experimentation. One of skill in the art would need to determine which one of the solid catalysts would be capable of forming the desired product and would furthermore then have to determine which one of the solid catalysts would not be resulted in the claimed desired compounds in a sufficient quantity.

Therefore, in view of the Wands factors and In re Fisher (CCPA 1970) discussed above, to practice the claimed invention herein, a person of skill in the art would have to engage in undue experimentation to test which solid catalyst can be employed to produce the desired claimed compound encompassed in the instant claims, with no assurance of success.

Claim Rejections - 35 USC § 103

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to

Art Unit: 1625

consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 1-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ushikubo et al (U.S. 5,380,933) in view of Bogan et al (EP 1193240).

Ushikubo et al teaches a method for producing an unsaturated carboxylic acid by subjecting an alkane to a vapor phase catalytic oxidation reaction in the presence of a catalyst containing a mixed metal oxide (see an abstract page).

The mixed metal oxide to be used as a catalyst component of the present invention comprises Mo, V, Te, O and X wherein X is at least one element selected from the group consisting of niobium, tantalum, tungsten, titanium, aluminum, zirconium, chromium, manganese, iron, ruthenium, cobalt, rhodium, nickel, palladium, platinum, antimony, bismuth, boron, indium and cerium, as essential components. Among the above elements for X, niobium, tantalum, tungsten and titanium are preferred. Particularly preferred is niobium.

(see col. 2

,lines 18-27).

Further, as a diluting gas, an inert gas such as nitrogen, argon or helium may be supplied. The molar ratio

of the alkane:oxygen:diluting gas:H₂O in the starting material gas is preferably 1:0.1 to 10.0:0 to 20:0.2 to 70, more preferably 1:1 to 5.0:0 to 10:5 to 40.

(see from col. 4

,line 67 to col. 5 , line 3).

When steam is supplied together with the alkane as the starting material gas, the selectivity for an unsaturated carboxylic acid is distinctly improved, and the unsaturated carboxylic acid can be obtained from the alkane in good yield simply by contacting in one stage of the catalyst layer, as is different from the conventional technique where a diluting gas such as nitrogen, argon or helium is added for the purpose of diluting the starting material. However, as a diluting gas to adjust the space velocity, the oxygen partial pressure and the steam partial pressure, an inert gas such as nitrogen, argon or helium may also be used together with steam.

(see col. 5 ,lines

4-15).

Furthermore, the prior art further specifies the process by the following examples (see from col. 6 ,line 52 to col. 7, line 59):

EXAMPLE 1

A mixed metal oxide of the empirical formula $\text{Mo}_1\text{V}_{0.3}\text{Te}_{0.23}\text{Nb}_{0.12}\text{O}_n$, wherein n is determined by the oxidation states of other elements, was prepared as follows.

In 325 ml of warm water, 15.7 g of ammonium meta-vanadate was dissolved, and 23.6 g of telluric acid and 78.9 g of ammonium paramolybdate were sequentially added thereto to obtain a uniform aqueous solution. Further, 117.5 g of an aqueous solution of ammonium niobium oxalate having niobium concentration of 0.456 mol/kg, was mixed thereto to obtain a slurry. This slurry was heat-treated to remove water and obtain a solid. This solid was molded by a tableting machine into a tablet of 5 mm in diameter \times 3 mm in length, which was then pulverized, sieved to from 16 to 28

EXAMPLE 2

0.37 g of a mixed metal oxide prepared in the same manner as in Example 1 was packed into a reactor, and a vapor phase catalytic reaction was conducted by supplying a feed gas in a molar ratio of propane:air:nitrogen = 1:7.5:7.5 at a reaction temperature of 380° C. at a space velocity SV of 1,734 hr⁻¹. The results are shown in Table 1.

EXAMPLE 4

0.55 g of a mixed metal oxide prepared in the same manner as in Example 1 was packed into a reactor, and a vapor phase catalytic reaction was conducted by supplying a feed gas in a molar ratio of propane:air:nitrogen = 1:15:14 at a reaction temperature of 390° C. at a space velocity SV of 1,871 hr⁻¹. The results are shown in Table 1.

TABLE 1

| | Conversion of propane (%) | Selectivity for acrylic acid (%) | Yield of acrylic acid (%) |
|-----------|------------------------------|-------------------------------------|------------------------------|
| Example 1 | 75.3 | 42.4 | 32.0 |
| Example 2 | 49.8 | 56.2 | 28.0 |
| Example 3 | 63.3 | 48.4 | 30.6 |
| Example 4 | 41.8 | 38.7 | 16.2 |

Art Unit: 1625

The instant invention, however, differs from the prior art in that the reaction pressures P^1 , P^2 , and P^3 are unspecified in the reaction zone.

Bogan et al discloses the method of producing unsaturated carboxylic acids by subjecting alkanes to vapor phase catalytic oxidation in the presence of $A_a M_m N_n X_x O_o$

wherein A is at least one element selected from the group consisting of molybdenum and tungsten, wherein M is at least one element selected from the group consisting of vanadium and cerium, wherein N is at least one element selected from the group consisting of tellurium and selenium, wherein X is at least one element selected from the group consisting of niobium, tantalum, titanium, aluminum, zirconium, chromium, manganese, iron, ruthenium, cobalt, rhodium, nickel, platinum, bismuth, boron, indium, arsenic, germanium, tin, lithium, sodium, potassium, rubidium, cesium, francium, beryllium, magnesium, calcium, strontium, barium, hafnium, lead, phosphorus, promethium, europium, gadolinium, dysprosium, holmium, erbium, thulium, ytterbium, lutetium, gold, silver, palladium, gallium, zinc, praseodymium, rhenium, iridium, neodymium, yttrium, samarium and terbium; and wherein $0.25 < a < 0.98$, $0.003 < m < 0.5$, $0.003 < n < 0.5$, $0.003 < x < 0.5$ and o is dependent on the oxidation state of the other elements.

(see page 6, lines 20-30).

[0065] Typical reaction conditions for the oxidation of propane or isobutane to acrylic or methacrylic acid may be utilized in the practice of the present invention. General conditions for the process of the present invention are as follows: the reaction temperature can vary from 200°C to 700°C, but is usually in the range of from 200° to 550°C, more preferably from 250° to 480°C, most preferably 300°C to 400°C; the gas space velocity, SV, in the vapor phase reaction is usually within a range of from 100 to 10,000 hr⁻¹, preferably from 300 to 6,000 hr⁻¹, more preferably from 300 to 2,000 hr⁻¹; the average contact time with the catalyst can be from 0.01 to 10 seconds or more, but is usually in the range of from 0.1 to 10 seconds, preferably from 2 to 6 seconds; the pressure in the reaction zone usually ranges from 0 to 75 psig, but is preferably no more than 50 psig.

(see page 10, paragraph #0065).

Ushikubo et al teaches expressly the method for producing an unsaturated carboxylic acid by subjecting an alkane to a vapor phase catalytic oxidation reaction in the presence of a catalyst containing a mixed metal oxide; similarly, Bogan et al (EP 1193240 A1) discloses a method of producing unsaturated carboxylic acids by

subjecting alkanes to vapor phase catalytic oxidation in the presence of $A_nM_mN_nX_xO_o$.


Both processes are commonly involved in the preparation of producing an unsaturated carboxylic acid by subjecting an alkane to a vapor phase catalytic oxidation reaction in the presence of a similar metal oxide composition. Furthermore, Bogan et al has offered guidance that the pressure range in the reaction process is from 0 to 75 psig (see page 10, paragraph #0065). Therefore, it would have been obvious to the skilled artisan in the art to be motivated to incorporate the Bogan's et al pressure range into the Ushikubo et al process in order to control and optimize the reaction process.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Taylor Victor Oh whose telephone number is 571-272-0689. The examiner can normally be reached on 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Thomas McKenzie can be reached on 571-272-0670. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 1625

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.


Taylor Victor Oh, MSD, LAC
Primary Examiner
Art Unit : 1625

10/1866